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Research Report 1505

Training Technology for the Operational Level of War

Kenneth W. Lucas and Patricia Harris
Allen Corporation of America

Steven R. Stewart
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June 1988

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This report examines the application of standards of performance concept of training for the Army's senior leadership at the operational level of war. Considering the environment and funding constraints on large-scale maneuver exercises, technology is the key to training. AirLand Battle Doctrine should be the basis for training today's senior leaders and for developing future leaders. The key tenet of AirLand Doctrine, synchronization, appears to be a construct that can be developed as a standard of performance measurement using state-of-the-art technology. In addition, successful application of the synchronization concept at the operational level of war requires the majority of the critical skills necessary for executive level leadership.

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FOREWORD

The work described in this report is part of an overall effort to develop a strategy for the use of simulation technology to develop decision skills useful at the operational level of war. Some sense of the decision complexity found at this organizational level had been obtained from an earlier content analysis of general officer interviews. For the present effort, an exercise using the Joint Exercise Support System (JESS) was observed to determine whether it requires decisions of this complexity.

The results of this assessment were briefed to personnel from the Combined Arms Center, Fort Leavenworth, Kansas, and the U.S. Readiness Command, McDill Air Force Base. The research will be used to develop simulations for use at War College level and beyond and to accelerate development of decision skills required of commanders and staff at Division levels and above.

Edgar M. Johnson

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TRAINING TECHNOLOGY FOR THE OPERATIONAL LEVEL OF WAR

EXECUTIVE SUMMARY

Requirement:

This research project has four primary requirements:

- To seek the relationships between executive level skills and the doctrinal requirements of AirLand Battle at the operational level of war.
- From the relationships identified, to develop a set of tentative critical performance objectives to use as evaluation criteria for current or future training methodologies.
- To examine the suitability of the Joint Exercise Support System (JESS) for measuring executive level performance outcomes in a simulated combat environment at the operational level of war.
- To investigate the possibility of a systems approach to training that would fill both executive development and operational requirements.

Procedure:

A review of historical documents, to include Army training and doctrine literature, was conducted to trace the evolution of the operational level of war and application of doctrine. A second purpose of this review was to define critical tasks in the implementation of current operational level doctrine that must be accomplished at the executive level. As a result of this review each of the tenets of Airland Battle described in FM 100-5 "OPERATIONS" was considered as a measure of executive level critical skills. Synchronization appeared to provide the greatest relationship with executive level skills and would therefore serve as a standard of performance measure.

A review of the JESS was conducted in the context of training senior echelon commanders and their staffs at the operational level of war. The review consisted of a literature review, examination of model documentation, and observing the system in use during U.S. Readiness Command's Exercise BOLD VENTURE 87 at Fort Lewis, Washington, November 1986.

Findings:

The Army needs to redefine its training strategy, increase the emphasis of training of the senior/operational level leadership, exploit technology to achieve the greatest training benefits for its expenditures, and pursue the application of the tenets of AirLand Battle for all operational level training. Synchronization appears to have a direct relationship to the critical skills used at the executive level of leadership and the potential for measurement.

The most serious deficiency of JESS as a training system at the operational level is the absence of submodels that train for and evaluate the skills required to achieve synchronization. Until the time that these essential submodels are developed and data can be collected to measure performance using synchronization as the base measurement, the JESS is more appropriately used as an exercise driver with applications for training of the command, control, and staff process. It does not, in its current configuration, meet the requirement as a trainer of senior level officers at the operational level of war.

Utilization of Findings:

Training of present and future operational leaders is a critical readiness requirement. Recent studies have demonstrated that the development of the critical skills is accomplished through sequential and progressive learning. Computer assisted battle simulations offers opportunity for effective and efficient training of current and future Army leaders. Essential, however, is the application of AirLand Battle Doctrine and measurable performance standards that can demonstrate the cognitive level abilities required at the highest levels of Army leadership. The Joint Exercise Support System, with some state-of-the-art improvements, has the potential of becoming an effective operational level training system.

TRAINING TECHNOLOGY FOR THE OPERATIONAL LEVEL OF WAR

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TRAINING TECHNOLOGY FOR THE OPERATIONAL LEVEL OF WAR

INTRODUCTION

The Executive Development Research Group (EDRG) of the Army Research Institute is engaged in a major effort to improve the developmental processes that result in the sequential and progressive growth of executive skills. Earlier work (Jacobs and Jaques, 1987) presented a theoretical model relating complexity and organizational echelon, based on a theory developed by Jaques (1978). The model focuses primarily, though not exclusively, on conceptual skill development as a key dimension. Recent work by others has supported this position (Isenberg, 1985, Streufert and Streufert, 1987, Sternberg, 1987).

Jacobs and Jaques suggest that a well-configured large organization will usually have seven discriminable levels that are divided into three broad bands. Simon (1976) uses the term "layers" to describe these organizational strata. Each level or layer poses a unique new set of conceptual requirements for decision makers and leaders. These new requirements do not replace those of lower levels, but rather are added to them, such that conceptual requirements become increasingly complex. The implication is that a part of executive development is constructing a conceptual frame of reference that enables the decision maker to understand the progressively greater complexity encountered at each higher organizational level.

The theory further suggests that the decisions and the thinking skills required at successively higher echelons may also be qualitatively different in nature. In this, the theory parallels and draws on the observations of Katz and Kahn (1978) concerning shifts in broad types of skill required across organizational levels. The lowest organizational layer generally focuses on accomplishing concrete tasks, and thus demands a focus on technical and interpersonal skills. Leaders generally have (or can seek) direct face-to-face contact with subordinates. Leadership at the lowest layer is "direct" in that results are achieved through direct assignment of tasks and direct motivation of effort toward task accomplishment.

Leaders in the middle organizational layer generally do not have such access. They usually are well removed from those involved in direct task accomplishment, and are concerned with critical tasks that do not involve direct supervision of those doing the task work. Their responsibilities are more toward finding indirect means to facilitate task accomplishment at the direct level. The work focuses on managing interdependencies among subordinate elements, and their differential resourcing in relation to mission requirements, as well as coordinating effort over time. Indirect facilitation poses an increasing requirement for conceptual skills and for the capacity for abstract thought. For these reasons, the theory postulates that growth of abstract analytic thinking skills is important in the middle layer.

Leaders in the top, or executive, layer are confronted with even more complex requirements. Executive leaders "add value" to their organiations in large part by instilling a sense of understanding and purpose to the general activities of the organization. In excellent organitions, there almost always is a feeling among members that the "boss" knows what he is doing, that he has shared this understanding downward, that it makes sense, and that it is going to work. However, gaining this sense of understanding is progressively harder at the higher echelons, particularly in terms of cause and effect relationships that are operational in any given situation. A number of factors make achieving clarity on cause and effect relationships especially difficult at the executive level. The time scale of events is increasingly long. In addition, there are many more factors to consider, among them contingency factors that are probabilistic in nature.

A consistent finding in the literature is that leaders at the executive level deal with the resulting uncertainty and ambiguity in at least two ways. The first is by developing a frame of reference that enables comprehension of the direct and indirect effects that combine to produce outcomes which may not be realized for some time into the future. The second is growth in conceptual skills and a resultant change in the approach to decision making. At the executive level, decision making appears not to be a selection from among formulated alternatives, based on an advantages/disadvantages comparison, but rather the formulation of "workable" solutions to problem situations. The executive approach is to develop a workable course of action and then to manage the outcome over time so that it will be successful. The "management" process may require solution of a number of smaller "problems" along the way. The conceptual skills required for this process include those developed for use at lower levels, including both abstract analytic skills and abstract synthesis skills. Analytic skills are essential for separating out the elements of a problem or situation. Synthesis skills are equally essential for seeing patterns -- and probably for creating patterns -- within a highly complex and seemingly disordered problem situation.

Research Strategy

The major focus of effort in this program of research has been to find ways of improving the growth process implicit in the development stages briefly described above.

The broad strategy has consisted of three primary thrusts:

- Defining the major dimensions of the executive conceptual frame of reference to confirm the "end-point" for the development process to both aid executive work and shape the early development processes.

- Determining if there is a "best" developmental sequence.

- Developing performance assessment and training methodologies to mediate the developmental sequence.

As described above, the theoretical model identifies different organizational levels and the critical requirements for leadership at each level. The model was tested for its applicability to Army organizations through a series of approximately 70 interviews with three- and four-star general officers and members of the Senior Executive Service. This test confirmed the nature of executive level work and the general categories of skills and abilities required of the Army's executive leaders. The results of this work led to publication of DA PAM 600-80, Executive Leadership. An expansion of this pamphlet also has been adopted for use at the Army War College.

Two postulates of the theory that seem to be supported by the work to date have important implications for the Army's executive development program:

1. The process of cognitive development is progressive and sequential.

2. Executives develop the required conceptual skills in an extended process of development that spans their entire careers.

Thus, for those who are to emerge as the Army's future leaders, there is a need to influence their development early and continue the influence systematically.

Progressive conceptual development appears to take place gradually as the skills and capabilities that comprise the current level are "overgrown" by the skills required at the next highest level. There is some evidence (e.g., Turlington, 1987) that the growth process can be influenced by exposure to "mental work" that requires a higher level of cognitive complexity. These stimulating activities can take many forms; conventionally, they are included in the programmed growth environment of the formal school experiences that are the "gates" for career progression. At present, these formal development activities stop at the senior service school level. The nature of the problem at this stage of the research is to determine what can and should be done to extend the sequential development process upward.

Executive Level Performance

Any attempt to extend development activities obviously must be considered in light of what executive leaders actually "do." The three- and four-star positions that comprise the executive domain operate at corps and above, at organizational levels where performance measures have yet to be developed. Performance at these levels now is generally, and probably inappropriately, evaluated on the basis of the cumulative performance of subordinate organizations. Thus, a major thrust of the research is to develop an understanding of executive performance that can be used to evaluate or design executive skill development activities.

Performance objectives for corps level and above are particularly critical in light of the recent revisions in the Army's warfighting doctrine. The 1982 and 1986 revisions of FM 100-5 established AirLand

Battle (ALB) doctrine that places renewed emphasis on the operational level of war. It requires battlefield commanders at corps and above to be able to perform the complex and coordinated actions that are called for in executing large-scale maneuvers. How to train those who must be ready to command at the operational level and how to infuse ALB doctrine throughout the Army's training program are issues that are currently under intense study. One area of particular interest is the role of computer-based simulations in operational-level training. This technology may hold the key to operational training that will enhance both readiness and executive development.

Research Objectives

The research effort reported in this paper had four overall objectives:

1. To seek the relationships between executive level skills and the doctrinal requirements of AirLand Battle at the operational level of war.

2. From the relationships identified, to develop a set of tentative critical performance objectives to use as evaluation criteria for current or future training methodologies.

3. To examine the suitability of the Joint Exercise Support System (JESS) for measuring executive level performance outcomes in a simulated combat environment at the operational level of war.

4. To investigate the possibility of a system approach to training that would fill both executive development and operational requirements.

JESS was selected for observation for two reasons: (1) foremost, the Army recently selected this simulation for purchase and fielding to each active corps, and (2) JESS was undergoing its final validation cycle at Fort Lewis, Washington, during the period of this study and was thus available for observation.

The interrelated activities involved in the research included:

- Examining the training implications of AirLand Battle

- Identifying organizational levels where operational art must be practiced

- Identifying a conceptual model of the specific skills required for operational-level leadership

- Evaluating the applicability of JESS for operational-level training

- Examining requirements for simulation-based training.
- Identifying the processes involved in infusing new doctrine throughout the organization

IMPLICATIONS OF AIRLAND BATTLE

Operational art is not a new concept in either world military history or the Army's own history. Yet, as noted by Jablonsky (1987), more than 30 years have passed since the U.S. Army practiced operational warfighting. Thus, it is new to the current generation of officers whose "rapidly waning warfighting experience is confined to the tactical victories and strategic defeat of Vietnam." The change has meant a reevaluation of training and readiness and a serious challenge to training resources and strategies.

The latest revision of FM 100-5 was introduced by the Commander, US Army Training and Doctrine and Command (TRADOC) in a keynote article in the March 1986 edition of Military Review (Richardson, 1986). The new doctrine was described as integrating sister services and NATO recommendations for improved execution of joint and combined operations. The operational level of war was the bridge or "linchpin" between strategic and tactical operations. Later statements by the TRADOC commander have added extra emphasis to the joint integration required for future battlefields, pointing out that training efforts should concentrate on "Army capabilities in the area of joint and combined operations" (Ganley and Schemmer, 1987).

However, the capability to execute this mandate through the use of joint forces in field exercises does not exist. The constraints of maneuver space as well as budgetary limitations preclude performance-oriented training at the operational level of war. Therefore, to date, only battalion level and below are conducting performance-oriented training and testing based on the concepts of AirLand Battle. Operational readiness above battalion is assumed to be equal to the composite readiness of subordinate elements. This assumption may no longer be valid in the context of an emphasis on deep strike and maneuver. Although small unit performance is essential, the key to AirLand Battle is large-scale maneuver on the battlefield to produce relative combat power at the decisive point. It seems plausible to assume that the skills involved must be measured on their own, rather than through the actions of subordinates. If this is to occur, two questions must be answered: (1) what command echelon will have the primary responsibility for executing the operational level of war, and (2) what skills must they possess to do so. The answers to these questions also are critical to further research into executive development.

Organizational Requirements and Operational Art

The doctrinal distinctions between the three levels of warfighting are described in FM 100-5 as follows:

- MILITARY STRATEGY: The art and science of employing the armed force of a nation or alliance to secure policy objectives by the application of force or the threat of force. Military strategy is the combination of military objectives (ends), military concepts (ways), and military force (means) to achieve national security policy objectives.

- OPERATIONAL ART: The employment of military forces to attain strategic goals in a theater of war or theater of operations through the design, organization, and conduct of campaigns and major operations.

  Campaign: a series of joint actions designed to attain a strategic objective

  Major Operation: the coordinated actions of large forces in a single phase of a campaign or in a critical battle; in effect, it decides the course of campaigns

  Operational art involves fundamental decisions about when and where to fight and whether to accept or decline battle. Its essence is the identification of the enemy's operational center of gravity -- his source of strength or balance -- and the concentration of superior combat power against that point to achieve a decisive success. <u>No particular echelon of command is solely or uniquely concerned with operational art</u> (emphasis added).

- TACTICS: The art by which divisions and smaller units translate potential combat power into victorious engagements and battles. Commanders win engagements and battles by moving forces on the battlefield to gain positional advantage over the enemy; by applying fire support to facilitate and exploit that advantage; and by sustaining friendly forces.

As the "linch-pin" between strategy and tactics, operations will act as integrator and translator for the battlefield. Operational commanders will be responsible for making the micro-world of immediate tactical combat meaningful in the macro-environment of long-term strategy. As noted by a Commander in Chief (CINC) of Army forces in Europe, "At the operational level . . . your goal is not to kill the enemy, but to provide opportunities for the commander at the tactical level to kill the enemy. Your operational objective is, put the enemy in harm's way" (Bolt and Jablonsky, 1987).

The echelon responsible for executing at the operational level will, of course, depend on the circumstances of the battlefield. FM 100-5 recognizes this uncertainty in its statement that the requirements of operational art are not restricted to any one echelon. However, performance-based training needs a target audience. The logic adopted for this research effort was that the target should be the echelon most likely to have to execute large-scale maneuvers -- the corps.

In a fully-mature theater, FM 100-5 identifies the field army or army group as exercising operational command, with divisions as the tactical command echelon. A corps could be found in either echelon, depending on the situation. Because of this unique location, it seems likely that any future combat situation that involves large-scale landpower will require the corps to either provide operational command or to translate operational level of war into tactics.

A further consideration was the nature of the work at corps level. The corps contributes to its subordinate organizations by:

- translating broad strategic guidance into operational concepts and plans
- maintaining a forward focus
- making adjustments in both balance of force and distribution
- to the extent possible, shaping future events to achieve favorable results

These functions are the underpinnings of the operational concepts of AirLand Battle and, as such, provide a likely target for performance-based training and evaluation. Before that can occur, the unique skills and capabilities required at corps level must be defined and performance standards identified that might measure these capabilities.

CORPS LEVEL PERFORMANCE

The work to date on executive development has been based on a systems theory of organization and leadership that defines three levels of requirements in the Army's warfighting structure:

- DIRECT (Battalion and Below)
- INDIRECT ORGANIZATIONAL (Division and Brigade)
- INDIRECT EXECUTIVE (Corps and Echelons above Corps)

These levels are differentiated by (1) the type of work accomplished; (2) the time span of tasks; (3) the type and number of relationships encountered; and (4) the level of complexity that must be dealt with.

Each level has certain critical tasks that must be mastered. Commanders at each echelon must have a "frame of reference" that allows them to understand the causes and effects of battle actions at their level. A frame of reference is a commander's mental map, an operating model of reality that is used to acquire and interpret information. As noted in the Introduction, general categories of skills and abilities required at corps and above have been identified.

It appears reasonable to assume that these identified skills will also be critical to corps commanders as they execute AirLand Battle at the operational level of war. Therefore these critical skills and

abilities have been subjectively translated and synthesized with the concepts of AirLand Battle. The translation and synthesis was accomplished by studying the concepts of AirLand Battle doctrine, reviewing doctrinal literature, and conducting discussions with experienced Army officers.

Critical Tasks At Corps Level

A corps commander's integrative role requires a frame of reference that enables him to translate the strategic theater and/or national plans and policies into tactical operational concepts for execution on the distributed battlefield. Specifically, he must have the cognitive capability to understand:

- the complex issues involved in the national and/or alliance political considerations that led to the decision to employ force in order to achieve stated objectives
- the military strategy and how it will lead to achieving national security policy objectives
- the campaign and how it contributes to achieving strategic objectives, and how the major operations of the plan fit together
- how to orchestrate battles and engagements that will lead to objectives set in the campaign plan

Orchestrating operational engagements is set in the context of (1) the time required to bring forces together to influence outcomes, (2) the time required to create change, (3) the capacity to sustain prolonged operations and (4) the complexity of alternatives that must be considered in an environment of uncertainty. Successful performance involves at least five critical dimensions: a future focus, reducing uncertainty, understanding the enemy's decision process, shaping the battlefield, and synchronization. His frame of reference must enable him to deal with each of these complex factors as they are described below.

Future Focus

A critical requirement at the operational level is to maintain a balance between the events of here and now and the events of the future. The trade-off between today and tomorrow is a factor in decisions at all levels. However, each level defines "tomorrow" differently. An operational commander's focus is on shaping events toward major operation and campaign objectives. At this level, tactical requirements become second and short-term advantages/opportunities may not be taken.

A second element of a future focus is understanding the time required to influence events. A major operation days into the future will involve elements and capabilities that must be gathered at the decisive moment. A realistic appreciation and understanding of time and space is critical

to operational command. However, such an appreciation is difficult to obtain except through experience.

Reducing Uncertainty

The uncertainty and complexity of warfare increases at each higher command level. At the operational level, reducing uncertainty requires developing expectations as to outcomes that either can occur or be made to occur. Commanders must analyze both friendly and enemy forces over time and space, using frames of reference sufficiently complex to understand the direct and indirect effects of their own and the enemy's decisions. At the tactical level, uncertainty is reduced by determining enemy capabilities and intent from observation and other available intelligence sources. Commanders at the operational level use this information to infer intent beyond what is obvious and observable. The ultimate objective is to modify enemy intent through deception and strategy.

Understanding the Operational Environment

Understanding the operational level environment requires timely and accurate information concerning the capabilities of both friendly and enemy forces. These are separate requirements that involve separate processes.

Intelligence gathering and interpretation is the source of infor-fation about the enemy's intent. Interpreting intelligence requires understanding the enemy's frame of reference and using a more complex frame of reference to create situations that will confuse and deceive him. The operational commander must be able to get inside the enemy's decision cycle to create battlefield situations where the enemy commander is reacting to what has already been completed while we are now doing something else. It requires both the capacity to understand faster and the capacity to execute faster, which, in turn, requires that more senior frames of reference have been shared with more junior leaders so that fully competent execution can occur on the basis of telegraphic orders. A commander uses his understanding of the second and higher order cause-and-effect relationship of events to create battlefield situations and opportunities. This is the operational commander's most significant contribution to his subordinates at organizational and direct levels ot the command.

Sensing the enemy's intent several days/weeks into the future is essential, but, in itself, is insufficient. The commander must also accurately project his own organizational capability. An effective feedback loop is required to assess capability several days into the future. Capability is as dependent on human factors (morale, fatigue, leadership, stress) as it is on the availability of hardware and munitions. If the human element is ignored or reality at the lower levels is not accurately assessed, the result may be a catastrophic failure.

Envisioning/Shaping the Battlefield

Having considered all elements and associated risk, the operational commander formulates a concept (a vision) and determines what the battlefield should be some days in the future. Shaping the battlefield may involve deception, conserving resources, and other activities to increase future success. The goal is to manipulate the perceptions of the enemy commander and to reduce his freedom of action while at the same time enhancing your own capabilities. To the extent the commander makes the battlefield more deterministic by projecting current trends, he reduces uncertainty. However, considerable risk is involved. If the enemy detects these actions, he is likely to change his own plans. The operational commander must continuously gather information, and "stay in the mind of the enemy commander," while at the same time reassessing his own capabilities. He must be flexible and ready to alter his vision to adjust as uncertainties become known.

As noted in FM 100-5, the operational battlefield will be one of joint and combined operations. The assets of all military forces must fit into the overall plan that is the result of the envisioning/shaping process. Operational commanders of ground, air, and sea forces must get into the minds of their enemy counterparts. They must share their perceptions of enemy intentions on the ground, in the air, and on the sea and collectively envision and plan into the future. This type of exchange and understanding is required if the forces are to be mutually supportive.

Synchronization

Throughout this process, the commander is moving toward synchronization -- arranging the battlefield in time, space, and purpose to produce the maximum relative combat power at the decisive point. An implicit component of synchronization is the capacity to sustain the force over prolonged periods. However, synchronization at the operational level is far more than concentrating fires and forces. It is also understanding the enemy and his intentions, then determining the arrangement of the battlefield necessary to take advantage of his weaknesses and to achieve decisive results.

Synchronization is the totality of combined effects of several activities that span over time to achieve desired outcomes. It may involve activities that appear totally unrelated. However, to the operational commander, they fit into the overall scheme to bring the battle, some days in the future, to a point of decision and conclusion as he had envisioned.

Critical Skills For Operational Command

The frame of reference described enables the critical skills required for executive-level command at corps and above. As shown in Figure 1, the skills can be grouped into three categories: cognitive/conceptual, technical, and interpersonal (communications). These are the skills that have been found to develop sequentially and progressively, from one organizational level to another.

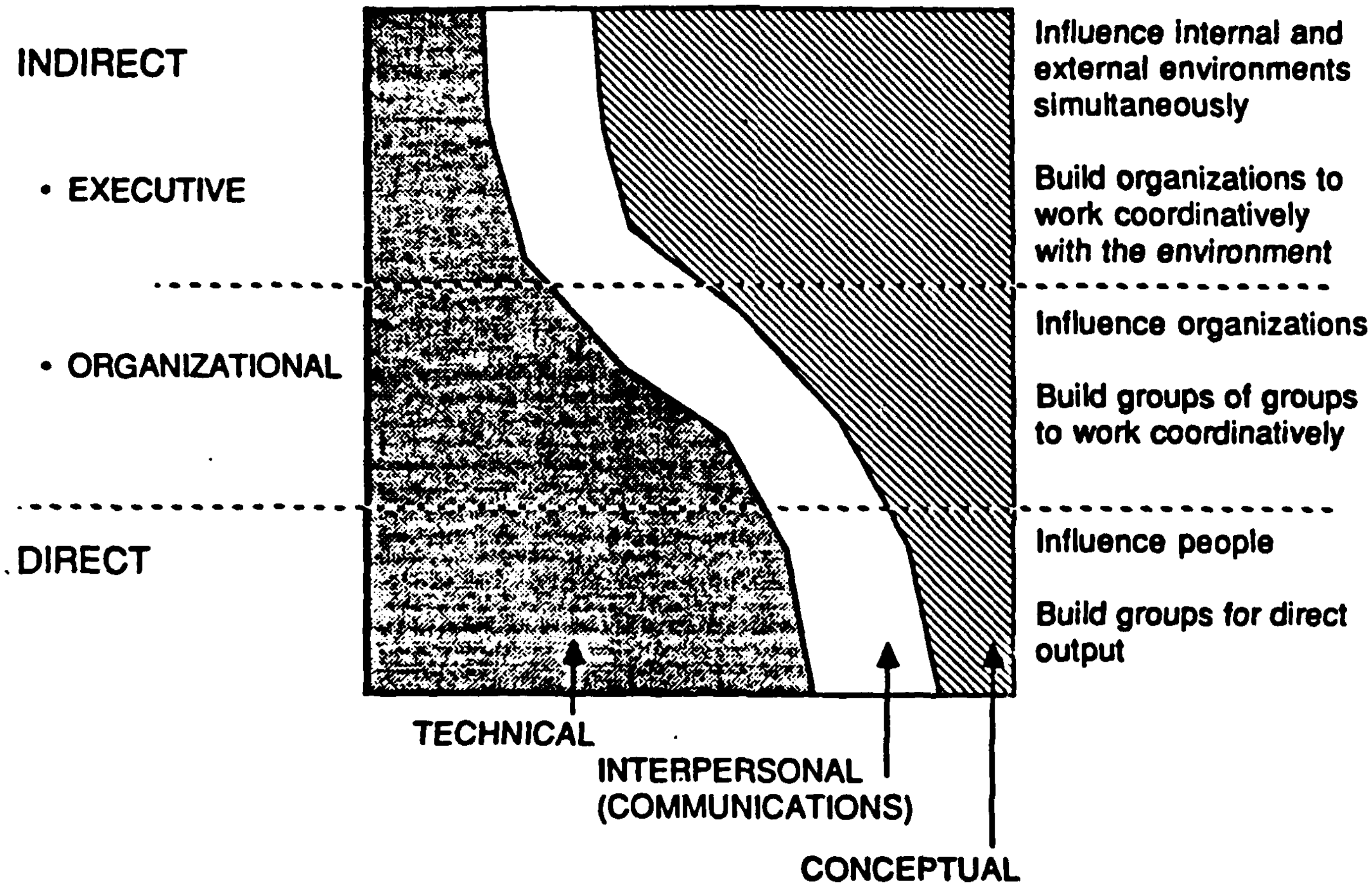


Figure 1. Concepts of Leadership

Cognitive/Conceptual and Decision Skills

Cognitive skills are necessary to understand the total organization, guide its progress, and place it properly within the context of the larger battlefield environment.

- Systems Understanding: the dynamics of the total system, how the system operates, and its interdependencies. At the operational level, the total system becomes Joint or Allied Command and a service command (Theater Army).

- Envisioning/Anticipating: dealing with extended time horizons and envisioning the future

- Proactive Thinking: anticipating future requirements; taking the necessary action to meet the requirements rather than waiting for them to develop and reacting

- Scanning: purposeful search for information relevant to an issue that has been conceptualized but not resolved (knowing where to look and how to extract useful information quickly)

- Problem Formulation: focusing on underlying causes of a problem, analyzing cause and effect relationships, looking for similarities among existing problems, and formulating a general approach toward solution

- Reflective Thought: creating frames of reference to aid situational understanding by habitually taking time to think through cause and effect, long-term implications and over-arching principles

- Personal Stamina: the capacity to tolerate uncertainty, take calculated risk, and rapidly modify current courses of action based on new information

Technical Skills

Technical skills at the executive level are primarily those of structuring force components and understanding both the capabilities and limitations of technology.

- System and Subsystem Development: creating new organizational capabilities in response to changing battlefield needs by combining forces or altering current structures

- Interdependencies: building interdependence among subordinate commands and with the other services and allies

- Technological Understanding: understanding technology's function in the organization to optimize time and capabilities

Interpersonal (Communicative) Skills

The third category of skills includes those involved in personal and organizational communications, including the ability to represent the Army in joint and allied relationships.

- Organizational Representation: ability to represent the organization to the external environment in a way that increases understanding

- Understanding People: the capacity to assess individual motivations, interpersonal dynamics and organizational power dynamics

- Communicating: the ability to exchange concepts by placing them in language understandable to an audience and the ability to listen, to hear accurately, and to seek to understand

Critical Skills and AirLand Battle

Although performance measures at the operational level have not yet been developed, the objectives of operational command are described in detail in FM 100-5. Operational commanders have two critical functions: (1) to understand the enemy's decision process, and (2) to orchestrate and synchronize their own operational and sustainment capability to achieve decisive results at the time and place of his choice. As formulated in AirLand Battle doctrine, operational goals will be attained through initiative, agility, depth, and synchronization, as well as sustaining the force in both time and space. The imperatives of sustainment described in AirLand doctrine are anticipation, integration, continuity, responsiveness, and improvisation.

Each of these principles and imperatives requires some or many of the critical skills identified above. However, one principle -- synchronization -- appears to require all of the skills and abilities necessary for executive-level performance. In addition, synchronization has a number of attributes that make it an attractive target for initial measures of operational-level training and performance. It is a macro-level concept that requires the coordinated performance of subordinate organizations. It is both a process and an objective. It is required for decisive engagement and decision on the battlefield. Most importantly, it is the only AirLand Battle principle that has been defined in terms of general objectives and outcomes.

Synchronization is described in FM 100-5 as follows:

> Synchronization is the arrangement of battlefield activities in time, space and purpose to produce maximum relative combat power at the decisive point. Synchronization is both a process and a result. Commanders synchronize activities; they thereby produce synchronized operations.

> Synchronization includes but is not limited to the actual concentration of forces and fires at the point of decision. Some of the activities which must be synchronized in an operation . . . may occur before the decisive moment, and may take place at locations far distant from each other. While themselves separated in time and space, however, these activities are synchronized if their combined consequences are felt at the decisive time and place. . . .
>
> In the end, the product of effective synchronization is maximum economy of force with every resource used where and when it will make the greatest contribution to success and nothing wasted or overlooked. To achieve this requires anticipation, mastery of time-space relationships, and a complete understanding of the ways in which friendly and enemy capabilities interact. Most of all, it requires unambiguous unity of purpose throughout the force.

A second definition comes from the current commander of SACEUR (DeVries, (1983):

> . . . the concentration of combat power at a specific time and place consistent with the commander's choice. It is the single conceptual focus of effort by a unit based upon the stated intent of the commander in both time and space.

In this context, "concentration of combat power" is not only the massing of equipment and personnel in time and space but, rather, the coming together of the effects of the combined operation.

A more detailed definition of synchronization has been given by General William DePuy (1984), in which he describes the concept in relation to maneuver doctrine. He makes an important distinction between the role of the commander and the role of the commander's staff. The critical prerequisite for the effective employment of any force is a clear and simple statement of the commander's concept. It reflects the commander's "scheme of maneuver," i.e., the objectives the commander intends to achieve and how he intends to use the assets available to him to achieve his stated objectives/intentions. This enables the functional area commanders to plan and execute their part of the battle. The commander's staff will further elaborate and schedule the actions in time and space.

The above discussion is not intended to imply that synchronization is the only performance measure of importance at the operational level. However, in the absence of other performance measures at this time, synchronization appears to be a reasonable proxy measure for the complex skills of executive leadership, one that can be used as at least a framework for evaluating current technology.

What then is needed is a performance exercising/measuring technology at corps/joint task force level which can both offer realistic challenge and reflect synchronization if it occurs. The Joint Exercise Support System (JESS) is generally viewed as the system that offers that capability.

JOINT EXERCISE SUPPORT SYSTEM

The Joint Exercise Support System (JESS) simulation has been selected as the Army's model for the command post exercise (CPX) driver portion of battle simulation requirements. In line with this decision, JESS has recently been purchased and fielded to each active corps. The utility of JESS for executive development was of particular interest to this research effort. As a result, arrangements were made for an ARI research team to observe the simulation during the BOLD VENTURE 87 exercise at Fort Lewis, Washington.

BOLD VENTURE 87 was coordinated by the Joint Chiefs of Staff (JCS), and sponsored by the U.S. Readiness Command (USREDCOM). It was a CPX designed to exercise I Corps, elements of 12th Air Force, and other selected forces (9th and 7th Infantry Divisions, 40th Mechanized Infantry Division (NG), and 41st and 157th Separate Infantry Brigades) in the conduct of joint/combined operations using a Korean contingency scenario.

Observation Methods

A four-member team was assigned to observe the exercise during a 11 day period from 11 to 22 November, 1986. Prior to the exercise, contact was established with the Director of Operations, J3, US Readiness Command, and the Commander, I Corps to identify the purpose and objectives of the exercise. Documentation and detailed specifications of the simulation were reviewed, and areas of particular interest for observation were identified.

The exercise was conducted in three phases. The preparatory phase involved training of controller players and establishing communications with player organizations. This phase consisted of two six hour training sessions each day from 12-14 November. The second phase was a 24 hour continuous communications exercise. JESS and all supporting systems were in full operation. The purpose of this phase was to insure all integrating systems were compatible as well as to provide controller players a warm-up practice session. The actual exercise was conducted on a 24 hour per day basis during the period 16 thru 20 November. The final phase consisted of a "hot-wash" critique held at the General Officer level, and an operating level critique conducted by the US Readiness Command's Internal Evaluation Team.

Two team members were assigned to observe the controller player operations center. One observer focused on the logistical and higher headquarters elements, while the other focused on the operational controller players, intelligence inferface and JESS control activities.

The other two team members observed activities across the entire spectrum from the controller operations to player Division and Separate Brigade level. A type corps level training process is show at Figure 2.

Observation data included:

- Pre-exercise controller training activities
- Operational activities of player control cells and their interface with the player units
- Logistical and administrative activities of the player control cells and their interaction with the player units
- Interface of JESS and TACSIM
- Role and activities of the Senior Exercise Controller and his staff
- Actions and decisions made at the JESS Master Control, "Magic"
- Activities of the simulated Joint Tactical Operations Center
- Decision making process at the player organizational levels (Corps, Divisions, and Separate Brigades)
- Long range planning process at the corps and division level
- Administrative and logistical activities at player organization level
- Organizational staff activities and integration
- Rear Area Operations Center activities at each organizational level

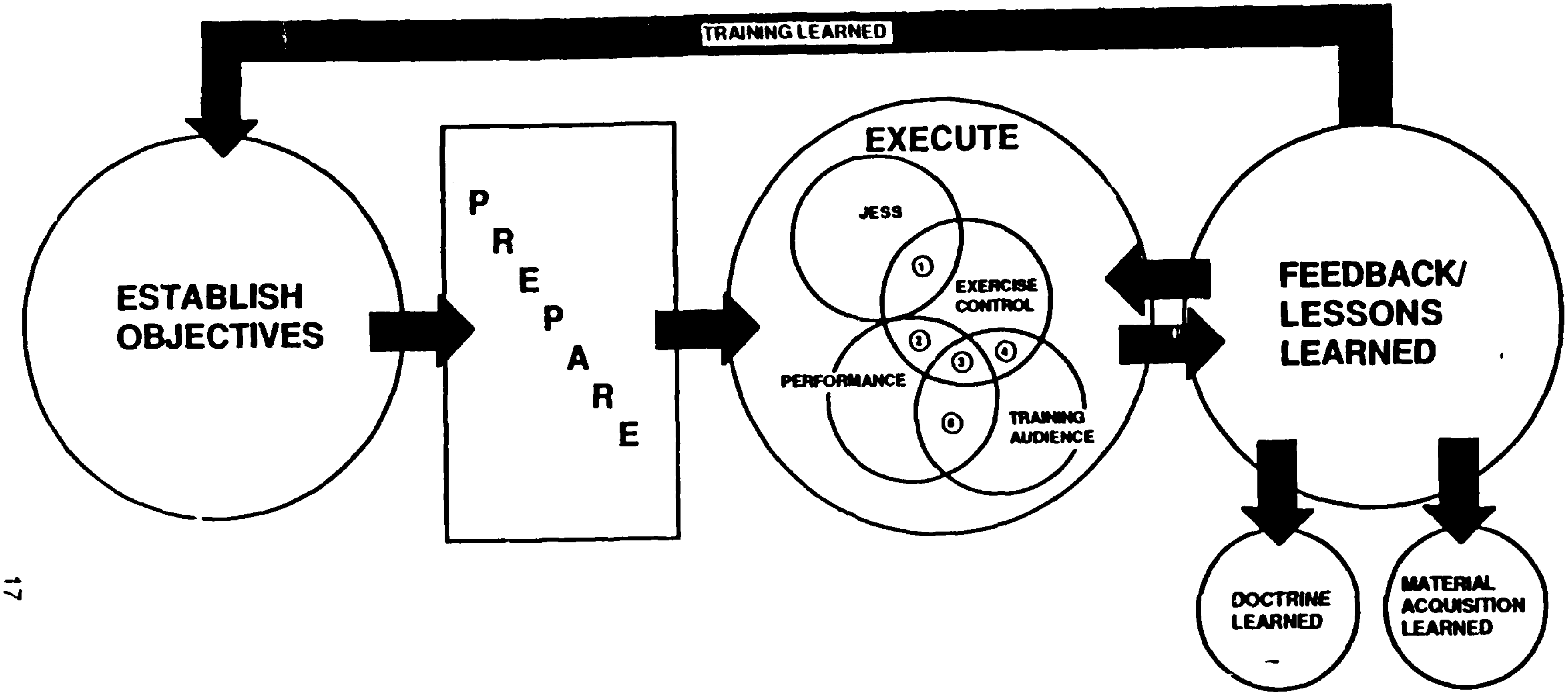
These data were supplemented by daily exercise reviews with the US Readiness Command's internal observation team, as well as frequent discussions with the exercise control staff, player controllers, the simulated higher headquarters staff members, player organizations command and staff personnel, and contract personnel representing the Jet Propulsion Laboratory.

Program documentation, observation results, and information from discussions with the participants were analyzed against the requirements of three applications: (1) as a combat simulator, (2) as a training technology, and (3) as a technology for executive-level training.

JESS as a Combat Simulation

JESS was developed to provide computer-based battle simulation support for Joint Readiness Exercises (JRX) and for training command and staff officers at the joint task force, corps, division, and brigade levels. JESS simulates combat, combat support and combat service support aspects of forces in battle. This includes movement, direct and indirect fires, maintenance, medical, supply, resupply, and close air support. A combination of graphics and menu-driven commands is available to send orders to the simulation and to control the workstations.

JESS is data driven, with the exercise data base developed independently (except for format) of the simulation software. The same software can drive a variety of different exercise scenarios. The number



• ESTABLISH TRAINING OBJECTIVES	• DEVELOP SCENARIO • LOAD SIMULATION DATA BASE • CONDUCT CONTROLLER TRAINING	• CONDUCT TRAINING	• PROVIDE FEEDBACK • DOCUMENT LESSONS LEARNED • DOCTRINE DEVELOPMENT
• EXERCISE DIRECTOR • SENIOR CONTROLLER • TRAINING AUDIENCE	• JOINT WARFARE CENTER STAFF • SUPPORT CONTRACTOR PERSONNEL • PLAYER UNIT CADRE	• PLAYERS -- CORPS -- DIVISIONS -- BRIGADES • JESS • PLAYER PERFORMANCE • CONTROL -- JOC -- BDE FRIENDLY -- OPFOR -- MASTER/SENIOR -- TOC MONITORS/OBSERVERS	• EXERCISE DIRECTOR • JOINT DOCTRINE HQ

1. FRIENDLY & OPFOR CONTROL
2. QUALITY OF CONTOLLER ROLE PLAYING
3. MASTER CONTROL & "MAGIC"
4. FRIENDLY CONTROL & JOC
5. INITIATIVE/PROACTIVITY OF PLAYERS

Figure 2. Overview of the Training Process

of units, weapon systems, and other entities that may be used for a particular scenario is limited only by the capacities of the supporting computer hardware. The rate of play is controllable. Game time may proceed faster or slower than clock time depending on the requirements of the exercise. Normal procedure is continuous play in real clock time. Controller players do not take turns, but act continuously to carry out their part in the exercise.

The specific characteristics of JESS as a combat simulator are described below. Comments regarding observed problems or anomalies are also included.

- Ground combat engagements for both direct and indirect fires are represented by Lanchester coefficients, derived through external analyses. Direct fires use Lanchester attrition equations modified within the simulation by factors that represent degradation caused by low fuel and low personnel.

- Indirect Fire missions against non-engaged units are represented by a linear equation that accounts for coverage fraction, a concealment factor, a posture factor, probability of kill, and tons of ammunition fired per hectare.

  Comment: Both direct and indirect fire equations use an aggregated and subjective approach that is not the most advanced technology. However, this did not appear to interfere with perceptions of validity and seemed to produce believable results.

  Comment: The controllers (opposition force) have the capability to execute missions with unrealistic ranges and lethalities that can detract from both training objectives and validity of the exercise. This potential trouble spot requires close monitoring by senior control personnel. It is possible also to influence control through adjustment to the software.

- Terrain is represented by an overlay of hexagons measuring three kilometers from side to side. Within a hexagon, data are used to describe such attributes as trafficability, vegetation, and elevation. When barriers are used, they are molded along the edges of the hexagons.

  Comment: Players noted a number of problems in using the hexagons, primarily associated with activities between opposing forces within a hexagon and in crossing a hexagon edge. Opposing forces occupying adjacent hexagons were automatically engaged. The problems are correctable by increasing the level of detail of event-scheduling logic and adding process models that represent the appropriate activities within the hexagon.

- JESS has substantial combat service support capacity. A large portion of the computer code is used to monitor supply levels at units and to respond to the allocation of resources and management of the combat service support function.

Comment: The data inputs for the combat service support models are for the most part aggregated and somewhat subjective, and not at the state of the art. The output appeared to be valid although input procedures were somewhat artificial. Software changes can reduce this artificiality.

- Air operations are not yet fully modeled. For this exercise, the air model was about 50 percent complete. However, resolution appeared to be adequate to support Army training.

  Comment: Increased resolution is necessary to stimulate and respond to command, control, and intelligence related to the employment of Air Force assets. Some anomalies were noted in air defense and air to air processes.

- Intelligence representation is provided by interface with the Tactical Simulation (Intelligence) TACSIM. The system capitalizes on the scope and specificity of TACSIM and ensures that a full range of intelligence resources is simulated. The allocation of electronic warfare resources, specifically ECM, was not observed.

  Comment: At the tactical leave, ECM should be included as a process. At levels above brigade, consideration should be given to implementing ECM effects through control of the exercise communication system.

A general observation was that JESS is not state-of-the-art technology. The level of resolution in space and time is not equal to that found in the current generation of similar Army models. The degree to which input data can be objectively traced to measurable parameters of performance is questionable. This may pose problems when new scenarios, area of operation, missions, and force structure are required. Although procedural training is possible, time-distance coordination processes have not been included. Thus, the cognitive conceptual skills that are the essence of command at the operational level cannot be challenged.

JESS as a Training Technology

Prior to the exercise, two criteria were selected to evaluate the system's utility as a training vehicle: the capability to introduce "probes" and a feedback mechanism that would allow assessment of player actions. A probe was defined as a stimulus or set of stimuli introduced by the exercise director as a situation that must be perceived, understood and dealt with by the JESS player elements. The probe should provide a circumstance conducive to evaluation, feedback, and consequently, training. Observations noted:

- Probes: While no action that could be construed as a probe was introduced in the observed exercise, it appears that the system could

accommodate a probe without major modifications. As the system was used during BOLD VENTURE, probes would have to be introduced at the exercise/senior controller level.

- Feedback: JESS capabilities for check pointing, restart, and recovery were observed following a system failure. However, the capabilities were not used during the exercise to enhance training. Options that would display the dynamics of combat as played have been considered. Technicians confirmed that it would be possible to "go back and start again," but that it would require significant activity on the part of the senior control staff and the complete set of players. The system does archive all inputs and outputs. Thus, it is possible to derive statistical data on timing of player actions and responses.

It should be noted that the JESS system was not used as a training vehicle in BOLD VENTURE. The participants from the senior level down focused their attention on the need to validate and "shake down" the system, rather than addressing the training value and characteristics of the system. Even so, JESS capability as a training vehicle would appear to be less than optimum in that it is not yet "instrumented" for training in the sense that:

- Software will not enable the senior-echelon commander to easily create and monitor activities related to the training of specific commanders, staff elements, or units.

- The system will not permit monitoring the performance of specific activities or the performance of specific staff functions.

- No software features have been implemented to facilitate local replay and feedback for training purposes during rather than after the exercise.

- Flexibility to change scenarios, tactics, force structure, and doctrine is accommodated by JESS. However, to do so requires considerable effort by data developers as well as by users to validate the input and to ensure that output is realistic.

The checkpoint, restart, and recovery capabilities noted above should not be confused with the requirement for input "probes" or a replay feedback capability. All large combat simulations, both closed form/systemic and man-in-the-loop, include these support routines primarily to deal with software or hardware failures. In effect, these are system programmer utilities. If the full potential of JESS as a training vehicle is to be realized, a set of training utilities must be developed, demonstrated and used. If this is to be accomplished, it is likely that the JESS development team will have to be augmented by training experts to support and guide the combat simulations experts.

Suitability of JESS for Operational Level Training

JESS appears to have been developed with an emphasis on communication and technical/procedural skills. These skills are important at all levels of command. However, training at the operational level has been found to require placing command and staff officers in an environment that stimulates decision making and command and staff interaction and coordination. JESS can generate an environment to exercise command communication systems and, to a limited extent, command and staff interaction and coordination. However, it does not appear to stimulate essential cognitive skills, shared command concept, or the intensity and precision of staff planning and time-distance coordination required of an operational-level training system.

For this observation, synchronization was included in the criteria as coordinated actions in space and time. The system was not found to elicit the planning, decisions, and execution of actions that lead to synchronization of multiple activities. The representation of synchronization depends on the resolution of time/space and the extent to which multiple process modules and status variables are examined prior to calculating effects such as attrition, modified by suppression of enemy air defense, counterfire, use of smoke, allocation of ECM, and maneuver to advantageous positions. Given the spatial and temporal resolution of the software currently utilized by JESS, synchronization cannot be elicited. The absence of this capability inhibits realistic feedback effects which underlie second order learning which must occur for JESS to be an effective operational level trainer of AirLand Battle doctrine.

From a modeling perspective, synchronization would seem to require nonlinear combat processes. Nonlinear effects generally require high resolution in time and space and careful treatment of the full range of conditions under which process dynamics and outcomes are calculated. An upgrade would require a major increase in data base size and model complexity.

A subjective model of executive skills required to achieve synchronization was compared to the JESS capabilities observed (Figure 3). It appears from this analysis that JESS has utility as a communications and procedural exercise trainer. However, without major modification, it has only limited capability as an operational level staff trainer (where time/distance planning and coordination is critical), and minimal capability as an executive/operational level development training system.

AN APPROACH TO TRAINING FOR SYNCHRONIZATION

An operational level commander will consistently lack all the information he needs to make decisions. Therefore, he must ultimately rely in part on subjective judgment. If the results of a combat decision are successful, it is seen as a good decision. Success, in fact, is not necessarily the result of good decisions, and "successful" decisions may not represent choice of the best alternative. Decisions made in a combat environment cannot be immediately evaluated. If they are ever analyzed,

CRITICAL SKILLS	SYNCHRONIZATION	TRAINING SYS. JESS
COGNITIVE		
Know Systems	X	X
Envisioning	X	0
Proactive	X	0
Scanning	X	0
Problem Formulation	X	-
Reflective Thought	X	0
Stamina	X	0
TECHNICAL		
Systems	X	X
Interdependence	X	X
Technology	X	X
COMMUNICATIVE		
Representational	X	0
Communications	X	X
Human Factor	X	0

NOTE: The critical skills are commander (individual) skills.

LEGEND:

- "X" indicates required for synchronization, and observed for JESS
- "0" indicates for JESS not observed
- "-" indicates for JESS as partially observed

Figure 3. Comparison of Executive Level Skills with Synchronization and JESS as a Training System

it usually is as a historical exercise based on old documents and anecdotal evidence. On the other hand, if a computer assisted battle simulation could measure the results of actions against a maximum solution, performance evaluation could be timely and the capability could be developed systematically against future contingencies.

The discussion thus far has identified the potential of the AirLand Battle principles, particularly synchronization, as a focus for performance-based training. The sections that follow will present an approach to capturing the core of operational art in a simulation-based training model.

Components of Synchronization

The underlying premise for synchronization is that the concept (the vision) of the commander must be understood by his subordinate, supporting, and adjacent commanders. As stated in FM 100-5:

> . . . Synchronization first takes place in the mind of the commander and then in the actual planning and coordination of movements, fires, and supporting activities. It need not depend on explicit coordination if all forces involved fully understand the intent of the commander, and if they have developed and rehearsed well-conceived standard responses to anticipated contingencies. . .

Synchronization, then, involves two, equally-critical components:

- Command Policies: Policies that provide a detailed set of specifications on how the organization is going to "do business," at a level of specificity sufficiently detailed to preclude the need for extensive coordination. Such policy guidance would come from the commander, and would have to be infused uniformly across the entire chain of command. The goal would be to achieve a uniform "behavior" throughout the command when reacting to events.

- Commander's Concept: An understanding throughout the organization of the commander's sensing of the battlefield, how he visualizes the flow of the battle, and how he plans to achieve maximum economy of force to bring maximum relative combat power at the decisive point.

These two components equate to the critical element of synchronization -- unambiguous unity of purpose throughout the force. The first component could be measured in garrison. The objective would be to assess uniformity of knowledge and consistency of policies and procedures. The second component appears to be a likely focus for simulation-based training.

A simulation to train for synchronization would need to include three separate areas of measurement. First, the commander himself would be assessed as to his (1) sensing, visioning, and time/space rationalization, (2) efficient integration of internal and external resources, and (3) clear articulation of his concept. Secondly, the simulation would measure the translation of the concept by each subordinate and supporting commander into explicit operating plans. Finally, measurements would have to be included of the commander's continual information gathering and processing and his adjustment of his concept (vision) as necessary to bring maximum combat power to bear at the right moment. A set of "straw man" measures for evaluating these actions is shown in Appendix A.

In general, measurements would need to capture the commander's judgment of how to conduct the operation and his synchronization of multiple activities in time and space to arrive at a successful outcome. Staff measurements would include the ability to develop the requisite coordination for precise time tolerances between the supporting arms needed to generate the "pulse" of combat power. Any combination of these components could be "wrong" or inadequate for the task at hand. Assessing whether an operation was successful in terms of synchronization would require the capability to "replay" the action with various modifications in timing and actions, seeking maximum solutions.

Measuring the Synchronization Construct

Measuring synchronization would require tracing an operational-level commander's cognitive process through to its conclusion of measurable outcomes. JESS does not provide this capability. Other simulations such as the Joint Theater Level Simulation (JTLS) and the State of the Art Contingency Analysis (SOTACA) can model analytical decision making. What is still needed is a more precise performance measure of the cognitive process involved in synchronization.

In a comprehensive literature review of over 90 industrial-based simulation game references, none was found to elicit the type of executive behaviors described in this report (Baker, 1987). However, current research does offer some hope in that it is being directed at the same sets of critical skills which have been identified as critical to the military executive. An approach that may be useful would be the development of a model which would keep track of the commander's decision process over time, while reacting to changing situations. This approach would begin to capture the cognitive process involved in synchronization. Such a model could produce a time event matrix that depicts the information gathering, data connections, and interactions that take place and how one event contributes to solving another task.

A exemplary time-event matrix has been developed from an actual combat operation example. Figure 4 shows the events that took place as a part of the initial Inchon invasion (Operation Chromite). General of the Army Douglas MacArthur planned the operation in the summer of 1950. The plan called for X Corps to make an amphibious landing at Inchon to link-up with forces of the Eight US Army and Republic of Korea forces

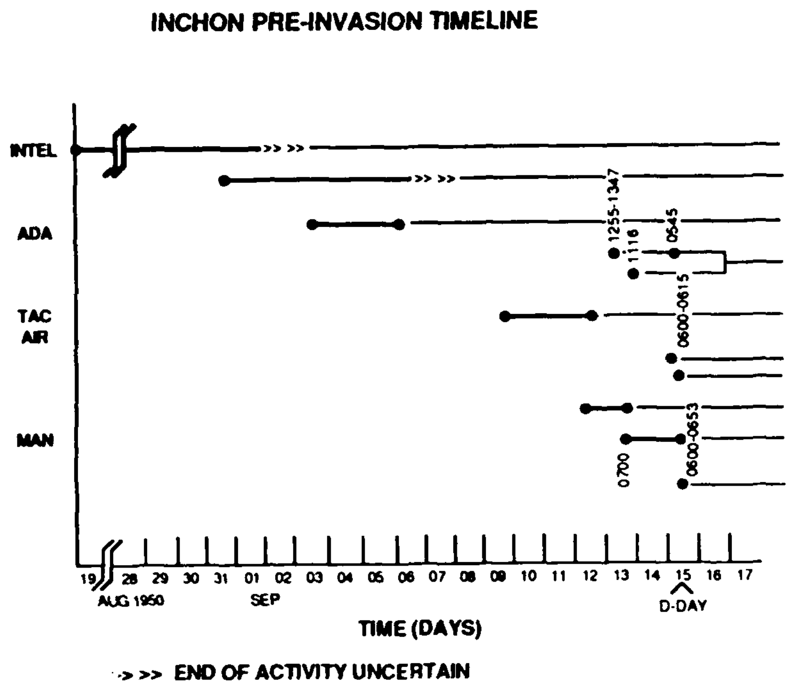
that were fighting for their existence inside the Pusan perimeter. This maneuver entailed great risk in that forces inside the Pusan perimeter initially had to conduct economy-of-force operations to effect a breakout to the northeast. Eighth Army and X Corps forces converged on the North Korean Peoples Army (NKPA) just south of Seoul, cutting off most of the NKPA's divisions. The overall effect on the NKPA was to destroy its center of gravity and cause the coherence of its entire effort to be shattered. Most of the NKPA divisions abandoned their tanks, heavy weapons, and supplies as they attempted to escape from the "jaws" in which they found themselves.

Figure 4 depicts the objectives that were to be achieved, the activity involved, the individuals assigned to execute each major activity, and the service arm that was assigned the responsibility for the conduct of the operation. It was possible to draw inferences from historical accounts about the intended interrelationships (interactions) of the events. These interrelationships are shown in Figure 5. Disregarding the exact timing aspects, the general interconnection of the activities should represent the concept for at least this portion of Operation Chromite.

In essence, this model is a primitive depiction of the processes that guided the operational level commander's thinking about how the operation should be conducted (i.e., what assets both physical and psychological should be used to create what effects). For a complete model, the effects would also have to be known and displayed, perhaps as a third dimension of Figure 5. If an actual record of the events could be pieced together from historical accountings, it should be possible to determine the extent to which synchronization was actually implemented as the operation unfolded.

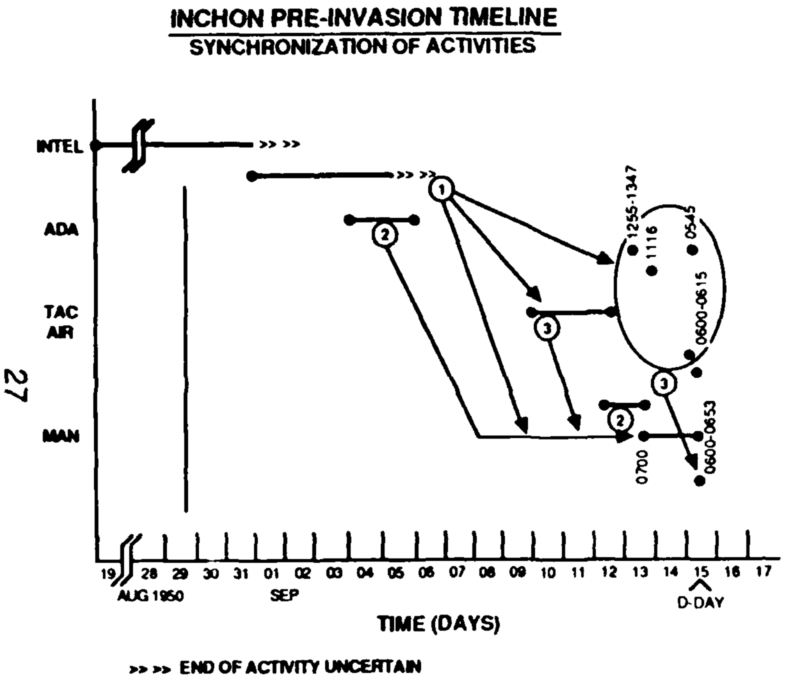
If a time-event matrix could be developed as a result of a series of events unfolding from a combat simulation exercise, and if the effects could be captured, the comprehensive graphic display would provide insight into how well operational concepts (intentions) were achieved. In addition, the effects of synchronization would be apparent in the overall display, as decisive combat power was brought together at the precise time and place. This would provide the necessary feedback to the commander to enable him to sharpen his own skills, as well as to identify organizational development needs.

Referring back to the example and Figure 4, it should be noted that each point represents the head of a dendrite. Coordination had to be effected within and across functional areas and echelons in order to cause the events which are shown to have occurred. Thus, it represents the end product of a myriad of planning and coordination activities from the most senior to the lowest echelons across the service arms involved.



OBJECTIVE	ACTIVITY	DIR/RESP	SERVICE
INFO FOR LANDING	RECON	LT LEE	KOREAN MARINE CORPS
INFO FOR LANDING	RECON	LT CLARK	US NAVY
DECEPTION	ARTILLERY FIRE	REAR ADM ANDREWS	BRITISH ROYAL NAVY
DESTROY KOREAN FORCES ON INCHON	ARTILLERY FIRE	CAPT SEARS	US NAVY
SEAL AREA/AIR SUPERIORITY/ DECEPTION	AERIAL BOMBARDMENT	UNKNOWN	US NAVY/BRITISH ROYAL NAVY
DESTROY KOREAN FORCES	AERIAL BOMBARDMENT	UNKNOWN	US MARINES
CLEAR LANDING AREA	AERIAL MACHINEGUN FIRE	REAR ADM EVEN	BRITISH ROYAL NAVY
DECEPTION	GRND ASSLT - KUSAN	COL ELY/LT POUNDS	US MARINES
POSITION FOR LANDING/ASSAULT	DESTROYERS/CRUISERS ENTER CHANNEL	UNKNOWN	SPECIAL OPS COY - 41 MARINE COMMANDO
LANDING MARINES ON INCHON	AMPHIBIOUS LANDING	LT COL TAPLETT	3RD BATTALION - 5TH MARINES

Figure 4. Inchon Pre-Invasion Timeline



OBJECTIVE	ACTIVITY	DIR/RESP	SERVICE	COORDINATION
INFO FOR LANDING	RECON	LT LEE	KOREAN MARINE CORPS	USN - CLARK
INFO FOR LANDING	RECON	LT CLARK	US NAVY	KMC - LEE USN - DOYLE
DECEPTION	ARTILLERY FIRE	REAR ADM ANDREWS	BRITISH ROYAL NAVY	7TH FLEET - STRUBLE
DESTROY KOREAN FORCES ON INCHON	ARTILLERY FIRE	CAPT SEARS	US NAVY	3RD BN/5TH MARINES - TAPLETT
SEAL AREA/AIR SUPERIORITY/ DECEPTION	AERIAL BOMBARDMENT	UNKNOWN	US NAVY/BRITISH ROYAL NAVY	TO BE DETERMINED
DESTROY KOREAN FORCES	AERIAL BOMBARDMENT	UNKNOWN	US MARINES	
CLEAR LANDING AREA	AERIAL MACHINEGUN FIRE	REAR ADM EVEN	BRITISH ROYAL NAVY	
DECEPTION	GRND ASSLT - KUSAN	COL ELY/LT POUNDS	US MARINES	
POSITION FOR LANDING/ASSAULT	DESTROYERS/CRUISERS ENTER CHANNEL	UNKNOWN	SPECIAL OPS COY - 41 MARINE COMMANDO	
LANDING MARINES ON INCHON	AMPHIBIOUS LANDING	LT COL TAPLETT	3RD BATTALION - 5TH MARINES	

(1) Reconaissance of conditions (height of seawall, tides, etc.) used to guide destroyers and cruisers into Flying Fish Channel. Information on defenses also useful for targeting. Completion required prior to start of entry to channel. (Entry must occur by 15 Sep 1950.)

(2) Deception activities precede landing operations and direct enemy attention away from Inchon. Timing does not appear to have been considered critical.

(3) Marine and naval bombardment of Inchon first enables uncontested entry of U.N. ships to landing area, later neutralizes threat to marine landing and minimizes resistance. Timing of naval bombardment critical in the moments prior to landing.

Figure 5. Interrelationship of Inchon Pre-Invasion Activities

Other Synchronization Measurements

Simulated synchronization would require that data representing the obtained outcomes of a series of actions, the timing of those outcomes, and the synergistic effects of combined arms/services be captured, in a format that would permit the type analysis described above. It is recognized that some of the effects of war, such as surprise, deception, and the introduction of new weapon systems, cannot be easily replicated in the simulation environment. The extent to which they will be reflected in outcome data will be more a function of how the "game" is played, rather than the inter-workings of the algorithms per se. Introducing these types of effects is man-dependent and a function of the exercise control mechanism.

A second required measurement is determining the "why" of events. A simulation cannot assess this component. An established and trained controller network could serve as a sensing tool to help identify the possible "whys" of event outcomes. Such a network would be difficult to construct and develop. Sensing the "why" of events/results implies the need to have a cognitive capacity equal to if not higher than the level of leadership observed. The type of evaluation techniques used at the National Training Center could be used as a model for the development of a controller network.

These two capabilities, plus the realistic role playing by the control response organizations (friendly and enemy players) to generate effects of war that the computer cannot accommodate (surprise, deception, etc.), should produce the necessary information to reconstruct the events and provide the data necessary to explain both <u>what</u> occurred and <u>why</u> these results were achieved.

One additional instrument could be developed to produce additional indices of the extent to which synchronization can be generated and maintained within a computer assisted simulation. The instrument would be a "probe" introduced by the exercise director to stimulate and stress the operational commander's cognitive capacities. It could also be used to stress components or the entire organization in areas important to doctrine development and testing. It would provide the mechanism for determining the sensing and adaptive capacity of the operational commander. Finally, it would be the mechanism that the exercise director could use to guide the exercise toward specific training objectives.

Measuring Command Policies

The extent to which simulation-based measurements would focus on the second component necessary for synchronization -- the degree to which the commander's concept pervades the structure of the organization -- would be dependent upon the level of participation of subordinate commands. If the subordinate commands extending down through the organizational structure are playing, the degree to which the commander's concept pervades could be assessed. However, a more precise measurement may be needed as part of the answer to "why" events/results occurred, and to

assess training value at subordinate echelons. If so, garrison measures would have to be developed to assess how accurately the commander's concept is reflected in policies and procedures, and how clearly subordinates understand the policies. These measurements could also assess the effectiveness of the operational commander. This unambiguous unity of purpose throughout the force is, according to FM 100-5, the most important element of synchronization.

A SYSTEMS APPROACH TO OPERATIONAL LEVEL TRAINING: CURRENT AND FUTURE

Change takes two forms: (1) evolution and (2) revolution. The latter is rapid, maybe violent, and is generally disruptive. Evolutionary change involves systematically producing environments that shape behavior to satisfy stated objectives. The introduction of AirLand Battle and the re-introduction of the operational level of war has placed requirements on current and future leaders that they have not experienced and therefore must learn. If this is to be an evolutionary change, implementation will require modifying the environment and shaping behaviors.

Many recent studies of the implications of this doctrinal realignment have turned to the German army experience for insight into operational-level warfighting. The Germans were particularly successful at infusing new doctrine throughout their combat structure. In general, the Germans found that the process required that doctrine be "fixed" in relative terms for a substantial period of time for changes to take effect. As General Erich Von Ludendorff (1920) noted:

> Perhaps the most important aspect of the German staff corps lay in the fact that its members were trained to judge events and make appreciations, operational and tactical, according to a definite and uniform system . . . to insure unity of tactical and operational procedures.

From all accounts, this infusion process was accomplished through a systematic, long-term approach that involved all aspects of education and training. The formal school system was at the vanguard of this change that was then inculcated into every training plan and practice.

Based on the German example, it appears that effecting change that will translate operational art into practice will involve a revamping of the Army's education and training system. All military training configurations -- institutional and unit, individual and collective -- will ultimately have to be based on AirLand Battle principles if the doctrine is to be successfully infused. Coordinating and integrating this training across echelons will require a systems approach that maximizes both training- and cost-effectiveness. The final thrust of this research was to consider what a systems approach to operational training might include.

Assumptions for Operational Training

Based on the requirements of both AirLand Battle and executive development discussed throughout this paper, the following assumptions were defined for operational training:

- Infusing operational doctrine throughout the Army must be an integrated effort that includes both institutional and unit training.

- Given constraints of budget and suitable terrain, operational training should be based primarily on simulations and other training activities that capture the complexities and uncertainties of large-scale opposing force maneuvers.

- Operational level training must be structured to develop specific operational level skills, and to differentiate between direct and second order effects. (Second order, indirect effects are usually predictable and must be considered as change is planned. If they are not, effects may occur that are neither anticipated nor desired.) In addition, these skills must be identified in a way that allows performance to be evaluated.

- Because AirLand Battle emphasizes thinking skills, the training system must have the development of cognitive ability as a top priority.

- Training must provide a realistic portrayal of combat, its associated stress, and the elements of human behavior at every organizational level to provide for the sequential and progressive development of leaders.

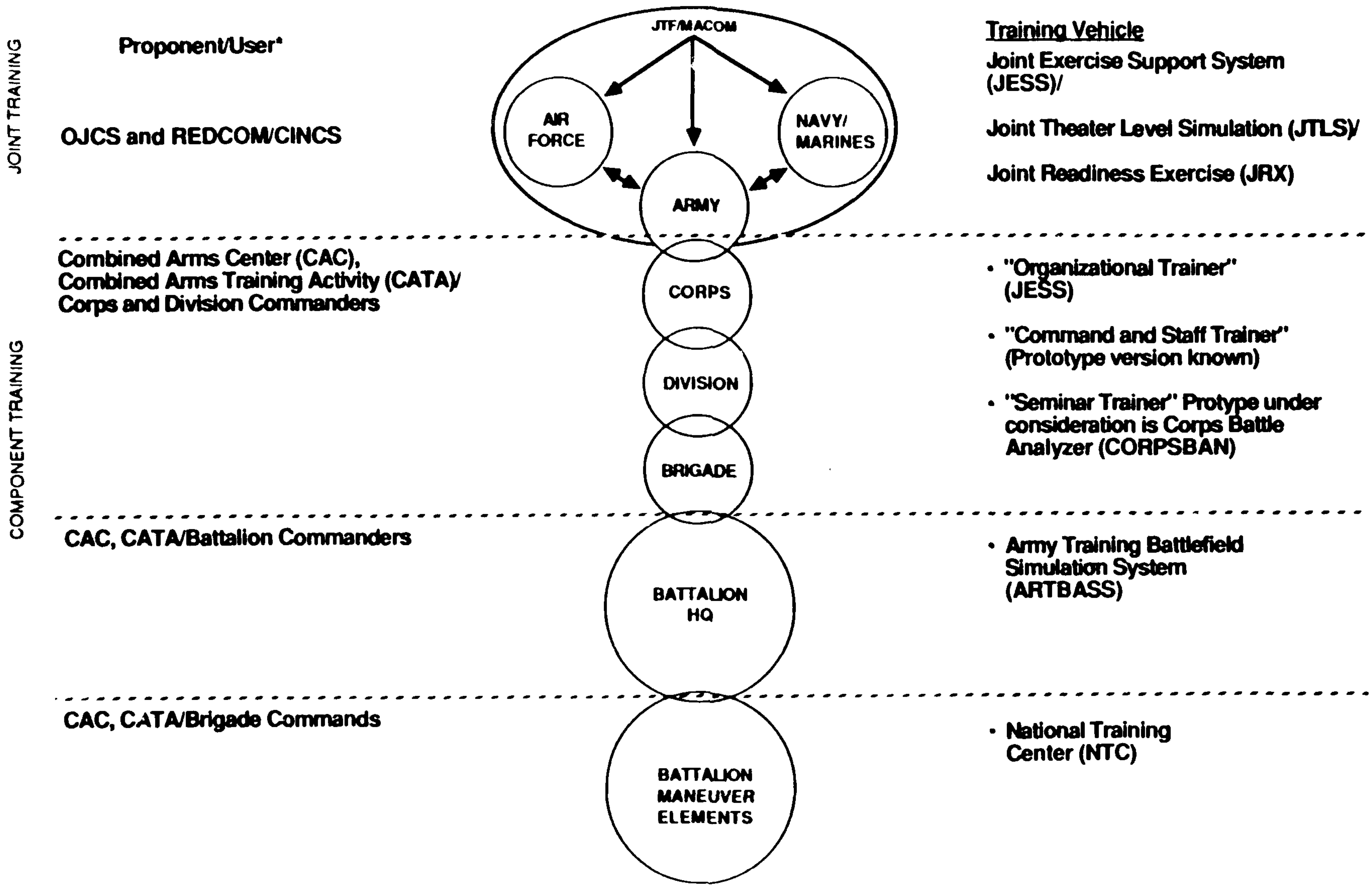
- Training should be viewed as a "readiness multiplier." Each echelon is accountable for the readiness of subordinate units and sets standards of performance and training objectives for those units.

- Operational level training should be an event for which all participants "train up," just as battalions now prepare for training at the National Training Center.

- Operational training should focus on the corps as the echelon most likely to have to execute operational-level command.

Current Capability

Using these assumptions, a simulation-based training system was designed, using current or developing training vehicles (Figure 6). The left column identifies the user, the right column shows the evolving training vehicle, and the center is the organizational level being trained. An important point is that the training organization is senior



* The user is presumed to be the Commander one Level removed from the one on which the training activity is focused.

Figure 6. Army Slice - National View of A Training System as Capstoned Within the Joint Service Environment.

to the organization being trained, in line with the requirement that the next higher echelon provides the essential context and climate for training.

Figure 6 also identifies the largest problem facing a systems approach to operational training. Nothing in the currently available technology has been identified that can continue the development of executive level skills to the operational level. One approach would be to develop a technology for executive-skill development, and add it to the current catalog of vehicles. Another would be to develop a new generation of training models for use throughout the Army that emphasizes the requirements of AirLand Battle by echelon.

The final section of this paper describes a training system based on the second strategy. As noted in previous sections, synchronization appears to hold a great deal of promise as a guide for both performance measurements and Army-wide training. However, the next section has been written as a general discussion of a simulation-based training system, leaving the detailed determination of the requirements for synchro-onization for future research.

A Future Strategy for Operational Training

Technology Requirements

The essential capability of a new training system would be to provide a progressive and sequential learning process of dealing with greater levels of uncertainty. Secondly, to be achievable in the context of current and foreseeable constraints of space and resources, it would make maximum use of technology for both individual and organizational training. Individual training would emphasize thinking processes in a wide variety of situational settings, whereas organization training would focus on the results of thinking. In both training settings, the prime effort and objective would be on understanding cause and effect linkages.

Corps would be the highest echelon to receive training, with a senior command, Forces Command, or MACOM as the training organization. An integrated, whole-Army approach would require either a single simulation that could be used on a reduced scale below corps level or a series of compatible simulations for use by subordinate units. The simulation or set of simulations must provide the capability to obtain measurable outcomes of performance objectives across echelons, e.g., weapon system engagements below corps and the more intangible concepts that are the domain of the operational level commander. At corps level, it must be more than a staff trainer. It must create an environment of complexity that stresses the cognitive skills of the operational level commander outlined earlier. In addition it must provide an explicit feedback loop that will permit maximum learning.

The new simulation(s) must be credible. Credibility considerations include: validity of battle engagement outcomes; applying appropriate weight for all combat multipliers; accounting for the full spectrum of combat power, including logistical and administrative services; crediting electronic warfare usage; weighting effective leadership -- use of terrain, deception, synchronization etc. In addition, the feedback system must allow easy identification of cause and effect relationships.

An effective new training vehicle must also be sufficiently transportable or adaptable to satellite communications, and capable of being used uniformly at the operational level of war across the total Army structure. This requirement is particularly critical to effective training of the "round out brigades" and other essential reserve forces.

Training System Requirements

The simulation or set of simulations described above would be the core of a system approach to operational training. Concurrent changes would need to occur at both the institutional and unit training level to achieve the total infusion of the doctrine of AirLand Battle throughout the Army.

Institutional Training. The objective of institutional training is to provide leaders with the necessary tools to continue their development processes. If operational-level leaders are to acquire the skills they will need, three factors will have to be integrated at the institutional level. First, the command mind-set that is developed during this period must be focused on operational requirements, including the joint frame of reference required for multi-service operations. Secondly, leaders must be made aware of the skills that are required at the operational level. At the senior college level, individuals currently receive a confidential assessment of behavioral qualities and leadership styles as a basis for self-reflection and charting a personal path of growth. The feedback from these evaluations should be in terms of skills that must still be developed for operational leadership.

Finally, individuals with the capacity to deal with the complexities of the operational level should be identified. Techniques are currently available that assess individual capability to deal with complexity. Identifying these individuals early in their careers will allow a more systematic process for building the skills that are required for operational-level leadership.

Organizational (Unit) Training. At the unit level, a total training system will require changes in command climate. The policies that establish climate must be those that create and reinforce the behaviors required for the distributed battlefield of AirLand Battle. One objective must be to achieve a degree of understanding that minimizes the need for coordination and control and facilitates the use of mission-oriented orders at every level of the structure. A second would be to encourage cognitive growth and thinking skills at all echelons.

Implications for Executive Development

The strategy for operational level training described above would seem to provide the direction for future research in executive development. The lack of current technology to train and measure operational level skills must be addressed. The role of institutional training in leader assessment and selection needs further attention. A promising avenue is a thorough investigation of performance measures based on the process and outcomes of synchronization. It appears that a set of simulations with the capacity to observe "what" happened and to explain "why" it happened would revolutionize training at the operational level of War. They might also provide the key to ensuring that the operational leaders of the future are identified and prepared.

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Appendix A

"STRAW MAN" CORPS PERFORMANCE REQUIREMENTS

Critical skills at corps level contain the performance requirements for mission accomplishment. Each of them can be analyzed to pinpoint the specific actions that must be taken. In the following list, five performance areas have been listed with possible actions. It is a "straw man" list of possible actions that could be evaluated.

PERFORMANCE AREA	ACTIONS
• Translating Strategy	• Develop Campaign Plan Identify enemy's center of gravity Revise and adjust to new information
• Sensing	• Intelligence gathering Force status data/information Sustainment capacity
• Visioning	• Formulate vision of battlefield Determine shape of battlefield
• Synchronization	• Develop tactical plans (battles and engagements) to arrange battlefield to advantage Systems integration Anticipate/create second order effects Retain flexibility
• Orchestrate Battles	• Provide opportunities for tactical level commands Resource tactical commands Integrated Information Personnel and material Combat multipliers Monitor current battles Integrate "other" capabilities Motivate tactical commands Sense human factors Collect information and assess future plans (adjust)